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3 FIREPROOF PROTECTION INTEGRATING FABRICATION  
4 SYSTEM FOR COMPOSITE STRUCTURES5  
6 [0001] The present invention relates generally to fabrication of composite structures in  
such a manner as to endow it with protective properties.7  
8 BACKGROUND OF THE INVENTION9  
10 [0002] Composite structures having a substrate made of a structural material such as  
glass/vinyl ester are presently utilized for shipboard use. Because of flammability concerns in  
11 regard to such structures, passive fire protection has been proposed involving attachment of  
12 insulation blankets by means of self tapping screws. Installation of such fire protection for  
13 composite structures is both labor intensive and costly, especially in Naval shipboard  
14 environments. It is therefore an important object of the present invention to provide less costly  
15 and less labor intensive fire protection for the foregoing referred to types of composite structures.16  
17 SUMMARY OF THE INVENTION18 [0003] In accordance with the present invention, during fabrication of a composite  
structure having a solid substrate made of a preferred shipboard material such as glass/vinyl ester  
19 or a sandwich type substrate, a protective barrier layer is applied to such substrate with a fire  
20 resisting agent such as phenolic resin, water or an oil-based intumescent coating. According to  
21 certain embodiments, the barrier layer is infused with the phenolic resin before attachment by  
22 adhesive bonding to the substrate. According to other embodiments, the substrate is formed at the  
23 same time the barrier layer is infused with the phenolic resin so that it attaches the barrier layer to  
24 the substrate without use of adhesive.25  
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#### BRIEF DESCRIPTION OF DRAWING

[0004] A more complete appreciation of the invention and many of its attendant advantages will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawing wherein:

[0005] FIG. 1 is a partial section view through a composite structure with which the present invention is associated in accordance with certain embodiments;

[0006] FIG. 2 is a partial section view of a composite structure in accordance with other embodiments; and

[0007] FIG. 3 is a block diagram of the procedure associated with fabrication of the composite structures illustrated in FIGS. 1 and 2, so as to provide it with damage preventing protection from fire under shipboard use.

## DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0008] Referring now to the drawing in detail, FIG. 1 illustrates a composite structure 10 which is to be utilized for example on a Navy marine vessel. Such composite structure 10 includes a substrate 12 that is solid as shown, made of a structural material such as glass/vinyl ester preferred for shipboard use. A fire protective barrier layer 14 is attached to the substrate 12 by a suitable bonding adhesive 16, such as a phenolic or silicone adhesive.

[0009] With continued reference to FIG. 1, the barrier layer 14 includes a core 18 formed by an intumescent mat or felt, protectively covered by a water proofing skin 20 such as an aluminum foil. A fire resisting agent is introduced into such barrier 14 before its adhesive bonding attachment to the substrate 12. Such fire resisting agent is either phenolic resin or water, or an oil-based intumescent coating infused into the mat core 18.

1 [0010] As an alternative, the barrier layer 14 may be formed from other materials into  
2 which the fire resisting agent, such as the phenolic resin, is introduced in-situ by scrimping so as  
3 to provide protection from damage from fire and high temperature conditions during normal use  
4 of the composite structure, as well as to resist water and solvent damage.

5 [0011] FIG. 2 illustrates a composite structure 10' fabricated in accordance with other  
6 embodiments of the present invention. Such composite structure 10' includes a substrate 12' of a  
7 composite type having a core 22 made of balsawood or foam. A fireproof barrier layer 14'  
8 protectively covers the substrate 12', made of an intumescent mat into which phenolic resin is  
9 infused in-situ during fabrication or formation of the underlying substrate 12' so as to be attached  
10 thereto without use of the bonding adhesive 16.

11 [0012] It will be apparent from the foregoing description, that the protective barrier layer  
12 14 or 14' covers either a solid type substrate 12 or a composite core type substrate 12' and that the  
13 fire resisting agent is introduced in-situ, for example by infusion of the phenolic agent, either  
14 before attachment of the barrier layer by bonding adhesive 16 or during formation of the substrate  
15 to avoid use of such bonding adhesive for attachment purposes. FIG. 3 diagrammatically  
16 summarizes the procedures involved, resulting in formation 26 of a fireproof panel pursuant to the  
17 present invention. Such procedures include formation 28 of the protective barrier from a barrier  
18 layer 30, such as the barrier layers 14 or 14', into which the fire resisting agent 32 is introduced,  
19 either before adhesive bonding to the substrate or during its formation 34 to avoid use of the  
20 adhesive bonding, before completing formation 26 of the composite structure as diagrammed in  
21 FIG. 3.

1 [0013] Obviously, other modifications and variations of the present invention may be  
2 possible in light of the foregoing teachings. It is therefore to be understood that within the scope  
3 of the appended claims the invention may be practiced otherwise than as specifically described.  
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